

BULLETIN OF MISCELLANEOUS INFORMATION No. 5 1940 ROYAL BOTANIC GARDENS, KEW

XXIII—SOME FISH-POISON PLANTS AND THEIR INSECTICIDAL PROPERTIES.

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The well-known insecticidal powers of the fish-poisoning plants belonging to the genera *Derris* and *Lonchocarpus*, now extensively used, have stimulated the search for others in many parts of the world, partly with the object of establishing local industries or of finding local means for the control of insect pests. Periodically such plants have been sent to this country for identification or for the assessment of their insecticidal properties. On other occasions plants have been sent by request, either because they were closely related botanically to the better-known species mentioned, or because it was desirable to have information on specific points, such as the effect of varietal differences or age on insecticidal potency.

None of the plants described in this paper possesses the same insecticidal power as the roots of recent selections of *Derris* and *Lonchocarpus*, yet it may be useful to give a brief account of their distribution, main botanical characteristics and their value as contact insecticides, more especially as, in some cases, the part of the plant used is more readily harvested than the root. There is also the possibility that more potent strains or varieties will be discovered or produced by plant breeding or selection.

The plants examined were:—*Barringtonia racemosa* Roxb., from Kenya (below); *B. asiatica* Kurz, from Arnhem Land, North Australia (p. 170); *Barringtonia* sp., from British Solomon Islands (p. 171); *Careya australis* F. Muell., from Arnhem Land, North Australia (p. 171); *Derris trifoliata* Lour., from British Solomon Islands (p. 171); *Dioscorea* sp. ("Tuba sakut"), from North Borneo (p. 173); *Dolichos pseudopachyrhizus* Harms, from Kenya (p. 174); *Ipomoea* sp., from Santa Isabella, British Solomon Islands (p. 175); *Jacquinia* sp., from Guayaquil (p. 175); *Millettia pachycarpa* Benth., from India (p. 175); *Ostryoderris gabonica* Dunn, from Belgian Congo (p. 176); *Tephrosia macropoda* (E. Meyer) Harv., from Natal (p. 177); *T. Vogelii* Hook. f., from Uganda (p. 178); *Tephrosia* sp. from Arnhem Land, North Australia (p. 180).

Barringtonia racemosa Roxb.

The genus *Barringtonia* consists of about three dozen species, many of them common trees in mangrove swamps. A few are to

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be found in East Africa and others in the tropics of Asia, Australia and Polynesia. Most of them contain saponin and it is this that may account for their use as fish-poisons and in native medicine.

Barringtonia racemosa is a medium-sized evergreen tree widely distributed in the warmer areas bordering the Indian Ocean. The fruits are reputed to be used for poisoning wild pigs in the Philippines. Some of the more primitive tribes in Malaya are said to pound the seeds and extract the starch for food, after pouring off the liquor which no doubt carries away deleterious substances. In India the root has medicinal uses. The bark is fibrous and rich in tannin.

Insecticidal properties.—The bark has been reported to have insecticidal properties. V. A. Beckley (*in litt.* to one of us) states that the natives of Kenya use it successfully as a fish-poison and that weak alcoholic extracts showed a fair toxicity to insects. R. R. le G. Worsley (Insecticidal properties of some East African Plants, in *Ann. Appl. Biol.* **21**, 658 : 1934) found that alcoholic and cold and warm aqueous extracts were completely toxic to *Citrus aphid* (probably *Toxoptera aurantii* Boy.) at concentrations representing 2–2.5% of the bark and also that the resin fraction contained the bulk of the toxic principles. A sample of the bark kindly sent to Rothamsted by Mr. Beckley showed no toxicity to *Aphis rumicis* when alcoholic extracts equivalent to 2% of the bark were tested. This sample may have lost its activity in transit, but it does not in any case seem probable that *B. racemosa* would replace the much more potent insecticides of the derris class.

***Barringtonia asiatica* Kurz (syn. *B. speciosa* Forst.)**

This species is also a medium-sized evergreen tree and is usually found near the sea. It has much the same distribution in tropical Asia and Polynesia, and has been recorded from various parts of northern Australia and Queensland. The tree normally occurs on open sandy beaches.

Both the fruit and the bark of this species are commonly used as fish-poisons. In the Philippines it is well known and the following description is given of the method of using it there—"A sufficient quantity of the bark, preferably taken from a mature tree, is cut into small pieces, which are then comminuted and mixed with earth in a wooden mortar. The proportion is about one part of earth to three parts of bark. The quantity of bark to be used depends upon the size of pond to be poisoned. The mixture is put in a gunny sack; a half-sack full has been found by experience to be sufficiently strong to kill fish in a pond of about a metre deep and eight metres in diameter. The time of application of the fish-poison has been found to be most satisfactory at early dawn; then by six or seven o'clock in the morning the stunned fish may be collected from the pool thus treated (*The Philippine Agriculturist*, **21**, 29 : 1932).

A sample of the bark of *Barringtonia asiatica* collected by Dr. Donald F. Thompson in Arnhem Land, Northern Territory, Australia, showed only a slight insecticidal potency when an alcoholic extract was tested at a concentration of 1% in terms of the bark.

Specimens of the seeds and husks, probably of a species of *Barringtonia* from the British Solomon Islands, also showed no toxicity to *Aphis rumicis*. Mr. Pagden, from whom this sample was received, reports (*in litt.*) that the fresh seed, ground with coral sand, is placed in a small bag and used for killing fish in rock or mud holes, the bag being squeezed to expel a little of the latex.

Careya australis F. Muell.

This Australian tree may attain to a large size but does not exceed 10 or even 5 metres in height in some localities. It occurs in the warmer or northern part of the Continent and has been recorded from various parts of Queensland near the coast and in Eucalyptus forest, in areas surrounding the Gulf of Carpentaria, in Arnhem Land, and some of the northern coastal districts of Western Australia.

Apparently the tree was well known to the aborigines and put to various uses by them. The pear-shaped fruit with its seeds was eaten when ripe (roasted) and cordage made from the fibrous bark, which was also used as a fish-poison. The pulped leaves were used medicinally for treating ulcers (F. M. Bailey, Queensland Flora).

We are indebted to Dr. Donald F. Thompson for samples of the bark of both branches and root of *Careya australis* from Arnhem Land, Northern Territory, Australia. Alcoholic extracts did not prove toxic to *Aphis rumicis* at a concentration of 1% in terms of the part of the plant. Hence this material is not likely to prove of interest as a contact insecticide.

Derris trifoliata Lour. (syn. *D. uliginosa* Benth.).

This species of *Derris* probably has a wider range of distribution than any other member of the genus. It occurs in India, Ceylon, Malaya, Indo-China, S. China, the Philippines, Polynesia, northern Australia, Madagascar and East Africa. It is usually found near the sea shore and on the banks of tidal rivers near mangrove swamps. It also occurs inland.

This has long been known as a common native fish-poison in many areas, particularly in northern Australia and many parts of Polynesia and the Pacific Islands. In India it is reputed to be used medicinally to some extent—as a stimulant, antispasmodic and counter-irritant. Rough cordage may be made from the tough stems of the plant.

Insecticidal properties. *D. trifoliata* (*uliginosa*) has been reported on several occasions to have insecticidal properties. Of six species tested by N. E. McIndoo, A. F. Sievers and W. S. Abbott (*Derris* as an Insecticide, in Jour. Agric. Res. 17, 177 : 1919), only *D.*

elliptica and *D. trifoliata* were found satisfactory insecticides. E. R. De Ong (The comparative insecticidal value of different species of *Derris*, in Jour. Econ. Ent. **23**, 619 : 1930) found the roots of this plant not only aphicidal but to be partially deterrent to the caterpillar *Euphydras chalcedona*. Samples of leaf, branch and root tested at Rothamsted in 1927 showed, however, little or no promise as insecticides. A three year old sample of the root grown in Malaya was reported by J. N. Milsum (*Derris uliginosa*, in Malay. Agric. Jour. **26**, 18 : 1938) to contain 5.0% ether extractives and 0.47% rotenone and thus to be of doubtful commercial value.

In 1934 samples of several plants collected in the British Solomon Islands were received at Rothamsted from Mr. H. T. Pagden. Three were *Derris* samples, recognised by the Government Botanist, Brisbane, as *D. trifoliata* Lour., and were specified as from Savo (root, stem), Gizo (root), and Tulagi (root). In addition, the stems and leaves of an unrecognised vine from Savo were received (it was later described by the Government Botanist, Brisbane, as indistinguishable from *D. trifoliata*). Mr. Pagden (*in litt.*) reports that the vine is used by the natives both in fresh and salt water for catching fish. The fresh leaves and stems after being ground up with coral sand are dropped in among a shoal of fish, when the majority are killed almost immediately.

Alcoholic extracts of the Savo root at concentrations (in terms of part of plant) of 1.0% gave a moribund and dead figure of 40%, the Savo stem at 2 and 1% concentrations 80 and 40% respectively, the Gizo root at 1% concentration 70%, while the Tulagi root showed no toxicity at or below 1%. They can thus be regarded as of little practical interest as contact insecticides.

The leaf and stem of the "vine" proved distinctly more toxic to *Aphis rumicis*. A series of tests carried out on three separate occasions within three weeks gave the figures shown in Table I. A relatively poor sample of *D. elliptica* root, tested on one of these occasions, is included for comparison. It contained 1.4% of rotenone and 6.8% of ether extractives.

TABLE I.

Toxicity to *Aphis rumicis* of a Vine from the British Solomon Islands.

<i>Description.</i>		<i>% Concentration in terms of part of plant.</i>			<i>% Moribund and dead insects after 2 days.</i>	
Vine—stem	2.0	...	...	100
		...	1.0	...	...	90
		...	0.75	...	...	50
		...	0.5	...	...	20
leaf	1.0	...	...	100
		...	0.75	...	...	100
		...	0.5	...	...	100
		...	0.25	...	...	65
		...	0.1	...	...	30

Description.	% Concentration in terms of part of plant.			% Moribund and dead insects after 2 days.		
<i>Derris elliptica</i> —root	...	0.14	...	...	100
		0.11	...	...	98
		0.09	...	...	87
		0.07	...	...	82
		0.05	...	...	44
		0.035	...	...	14
Controls	—	...	3

The vine clearly does not possess the same degree of insecticidal potency as the sample of *D. elliptica*.

Further samples received in 1935 confirmed that the leaf of the vine was more toxic than root or stem, but not to be of the same order of potency as the roots of *D. elliptica* now available.

In 1936 a specimen of derris root was received from Vella Island, British Solomon Islands, collected by Mr. R. A. Lever and said to be a very potent fish-poison. The natives use stems, leaves and roots for fishing in the sea. The root was completely toxic at a concentration of 1% and accounted for 73% of the insects at 0.5%. The whole series of results obtained with *D. trifoliata*, although indicating that there are strains or physiological races of different potencies, do not show this species to be capable of commercial exploitation in competition with either *D. elliptica*, *D. malaccensis* or certain species of *Lonchocarpus*. The fact, however, that a vine of rather indefinite botanical description but apparently *D. trifoliata* possesses leaves and stems showing toxicity to insects is of considerable interest.

Dioscorea sp.

Dioscorea piscatorum Prain & Burkill is a large climber found in Malaya, Sumatra and Borneo. The tubers, which are near the surface and sometimes protected by thorns, are red in colour and well known to the Malays as a fish-poison, being called by them "tuba ubi." The Sahai in Malaya are said to eat the tubers after roasting, the toxic or deleterious substances being destroyed by heat (I. H. Burkill, A Dictionary of the Economic Products of the Malay Peninsula).

Insecticidal properties. A sample of the tuber of "Tuba sakut." provisionally identified as *Dioscorea flabellifolia* or *D. piscatorum*, was received at Rothamsted in 1933 from the Imperial Institute. It was sent from North Borneo to the Imperial Institute and was reported as a more potent fish-poison than many species of *Derris*. Alcoholic and aqueous extracts showed only a very slight insecticidal action, but the expressed sap itself showed rather more potency, but not to such an extent as to warrant an extended investigation.

***Dolichos pseudopachyrhizus* Harms.**

The genus *Dolichos* is well represented throughout Africa and there are several species which possess fleshy or tuberous rootstocks. These are edible in some instances and used by the natives as food. The above species is of special interest on account of the large dimensions the rootstock sometimes attains, for it may reach 20–25 cm. in diameter and weigh 20–30 lbs. or more. It is not edible.

The plant has a wide distribution in the warmer parts of Africa and there is little doubt that several distinct geographical forms or varieties of it exist. It occurs generally in open savannah or slightly wooded country, and sometimes in tall grass.

Several separate climbing or scandent stems may arise from each tuber. These trail over trees or rocks extending sometimes as much as 12 metres.

The rootstock may be somewhat corrugated externally and is covered with a thick laminated brown bark which no doubt affords good protection under desiccating conditions. It contains much fibrous tissue when mature. Various writers and collectors have referred to the alleged poisonous nature of the tubers and their use by natives in poisoning fish. Broun and Massey (Flora of the Sudan, 203) state that "both the tubers and the beans contain a poisonous resin which is an active fish poison" and that "in the Bahr El Ghazal the tuber is mixed with the sap of the 'Heglig' (*Balanites aegyptiaca*) and used as a substitute for soap."

The present sample of root was examined anatomically at Kew (by Dr. C. R. Metcalfe) and compared with another sample of root from the dry coastal area of Kenya, alleged to be *Dolichos pseudopachyrhizus*. The two specimens were found to be similar in general characters, but there were small differences, notably in the structure of a portion of the starch grains and in the presence or absence of crystals, suggesting that the two specimens may have originated from different forms of the plant—or even from different species.

Insecticidal properties.—The sample was received at Rothamsted in August 1936, from Mr. E. W. Bovill, and was derived from Taveta, from the Kenya side of the Kenya-Tanganyika frontier, near Mount Kilimanjaro. It is reported that the natives boil the bulbous root and use the resultant fluid for the removal of ticks, etc., from sheep and goats. It is also reported that a little rotenone has been found, but whether the term is used in a general sense for a rotenone-like substance is not known.

The root was received in an undried state. A portion of it was dried at about 35°C. and alcoholic extracts made of both the dried and undried material. The toxicities of the extracts were determined in threefold replication using *Aphis rumicis* as a test subject. The extracts of undried root showed very little insecticidal action at concentrations of 2% or below, probably owing to the large amount

of moisture present. The results for the dried root were as follows :—

Concentration in terms of root.	% of insects paralysed.
1.0 ...	100
0.5 ...	83.2
0.25 ...	17.2
Controls—Alcohol 10%	
Saponin 0.5% ...	6.9

These results, while showing a definite insecticidal effect, demonstrate that this root is not of commercial interest, but that it might have some value for local use.

Ipomoea sp.

A sample of the tubers of a species of *Ipomoea* was received from Santa Isabella, British Solomon Islands, through the Imperial Institute. The tubers contained much sap. Alcoholic extracts were not toxic to *Aphis rumicis*:

Jacquinia sp.

Jacquinia Sprucei Mez (*Myrsinaceae*) occurs as a low bushy tree in Guayaquil in Ecuador. Several observers, including Robert Spruce, have recorded the use of the small orange-like fruits in Ecuador for stupefying fish.

The fruits of what was considered at Kew to be a species of *Jacquinia*, probably *J. Sprucei* Mez, and derived from Guayaquil, being known there as "Barbasco" and used as a fish-poison, were without toxicity to *Aphis rumicis*.

Millettia pachycarpa Benth.

Over 60 species of *Millettia* have been recorded from different parts of India.

Millettia pachycarpa, a strong-growing woody climber, might easily be mistaken for a species of *Derris* when not in flower or fruit, for its vegetative characters and general appearance are very similar. Like *Derris* it is well known as a fish-poison plant and is commonly employed by natives to procure fish from the hill streams and pools in regions where it grows. According to Brandis (*Indian Trees*, 219 : 1906) the fruit of this species is used for intoxicating fish besides the milky juice of the root. An allied Indian species which is also used as a fish-poison is *Millettia auriculata* Baker.

Insecticidal properties.—The genus *Millettia* contains several species with insecticidal properties. K. Nagai (*Journ. Tokyo Chem. Soc.* **23**, 744 : 1902) isolated rotenone as one of the constituents of *M. taiwaniana*. T. Kariyone, K. Atsumi and M. Shimida (*Journ. Pharm. Soc. Japan*, No. 500, 739 : 1923) confirmed this result and showed that this compound was common both to this plant and to *D. elliptica*. It was due to this work that the name "rotenone" replaced all others for the chief active principle of the fish-poison

insecticides of *Derris* and *Lonchocarpus* species. The root of *M. auriculata* is stated by N. E. McIndoo and A. F. Sievers on the authority of Greshoff (1913), to be used as an insecticide. (Plants tested for or reported to possess insecticidal properties, in Dept. Agr. U.S., Bull. no. 1201, 44 : 1924.) Chin Pi Chen (Science (China), **19**, 1405 : 1935, and Chem. Absts. **30**, no. 1, 225 : 1936) reported *M. pachycarpa* to be both a contact and stomach poison to insects, to contain much saponin and possibly rotenone. It is listed as an Indian fish-poison by M. B. Raizada and B. S. Varma (Indian Plants reported as Fish-poisons, in Indian Forester, **63**, no. 4, 198 : 1937). T. P. Ghose and S. Krishna (Occurrence of rotenone in *Millettia pachycarpa*, in Current Science, **6**, 57 : 1937) found the roots to contain 4% of total resins and 1.2% of rotenone.

The specimen tested at Rothamsted was received from the Forest Research Institute, Dehra Dun, U.P., India, in 1937 and was probably derived from the same source as that analysed by Ghose and Krishna.

An alcoholic extract was made and diluted with saponin solution, so that each concentration used contained 0.5% saponin and 5% of alcohol, and atomised in the usual way upon the adult apterous females of *Aphis rumicis*. The results were :

Concentration expressed in terms of root.	% paralysed.
1.0 ...	100
0.5 ...	100
0.25 ...	100
0.1 ...	55
0.05 ...	20
0.025 ...	5
Controls—Saponin 0.5%	
Alcohol 5.0% ...	5

The results show this root to have a relatively high toxicity, better than the leaves of *Tephrosia Vogelii* and equal to the root of *T. macropoda* which were tested at the same time. The insecticidal potency of the root of *M. pachycarpa*, however, is not of the same order as that of the rotenone-rich specimens of *D. elliptica*. Unless greatly improved by selection it could not commercially compete with the latter, but where locally available, it should prove of value for purposes of insect control.

***Ostryoderris gabonica* Dunn.**

Ostryoderris is a small genus of trees or woody climbers in tropical Africa which is allied to *Derris* and *Lonchocarpus*. Four species occur in West Tropical Africa, *O. gabonica* being one of them. It is a straggling or climbing shrub found in southern Nigeria, the Cameroons and Gabon, and may occur further East. As far as is known the plant does not possess any special economic properties.

Insecticidal properties.—Samples of root, stem and leaf of this plant were obtained from the Jardin Botanique d'Eala, Belgian Congo, through the kind assistance of the Director General, Ministry of Colonies, Brussels. The plant is known locally as "Bolemba."

Tested on *Aphis rumicis* the following results were obtained :

Concentrations tested.			% paralysed insects.		
%			Stem.		Root.
5	...		100	...	100
2	...		70	...	90
1	...		0	...	20
Control—Saponin					
	Alcohol		3	...	3

The leaf was not insecticidal.

While interesting, these results show that no part of this plant is comparable in insecticidal activity with *D. elliptica*.

***Tephrosia macropoda* (E. Mey.) Harv.**

This *Tephrosia* is considerably smaller than *Tephrosia Vogelii* and is straggling in habit, seldom exceeding 7-8 dm. in height. Its distribution is also very much more restricted for it occurs only in the eastern portion of South Africa. It is common in parts of the coastal grassveld of Natal and Zululand.

A variety (var. *angustifolia* E. Mey.) with smaller narrower leaflets, and altogether a smaller plant, has been recorded from Natal and the Eastern Cape Province, but whether its toxic or piscicidal properties differ from those of the ordinary form is not known. Experiments with *T. macropoda* in Natal have shown that it is of fairly rapid growth and responds well to cultivation, producing a larger and less twisted rootstock than in the wild state. The root may be 45 cm. in length and is straight and tapering in well-tilled soil.

In districts where it occurs the plant is well known to the natives as a fish-poison, the root only being used. It is also employed by them in freeing the head of vermin and for medicinal purposes. It is applied externally to sores and in skin complaints, and is also said to be a specific (after roasting) in enteric fever and to be used as an anthelmintic for cattle. In early days the roots were used by settlers as a wash for ridding dogs of fleas.

Insecticidal properties.—Tattersfield and Gimingham (The insecticidal properties of *Tephrosia macropoda* Harv. etc., in *Annals Appl. Biol.* **19**, 253 : 1932) have already reported upon the toxicity of samples of *T. macropoda* from Natal to *Aphis rumicis* and to larvae of *Selenia tetralunaria* and *Orgyia antiqua*. Howes (*Tephrosia macropoda* as a possible insecticidal plant, in *Kew Bulletin*, 1937 : 510) has described the results of experiments in Natal designed to obtain information upon the behaviour of the plant when cultivated. A sample of *T. macropoda* roots (cured under cover) was received in

1934 from Dr. A. P. D. McClean of the Natal Herbarium, Department of Agriculture and Forestry, Durban. The ground root was extracted in the cold by soaking with absolute alcohol, and the extract, diluted with 0.5% saponin solution, tested against *A. rumicis*. The results were as follows:

% concentrations tested in terms of root.		% paralysed insects.	
0.25	...	96	
0.10	...	53	
0.05	...	30	
Controls	...	20	

Two further samples of roots one and two years old respectively, from an experimental plot, were received from Dr. McClean, via Kew, in 1935 and 1936. These were tested as before against *A. rumicis*. The results were:

% concentrations tested in terms of root.		% paralysed insects.		
		1 year old root.		2 year old root.
0.5	...	100	...	100
0.25	...	96	...	100
0.20	...	90	...	—
0.10	...	14	...	50
0.075	...	—	...	20
Controls	...	3.8	...	3

The leaf of the plant one year old showed little or no toxicity when tested at 1.0% concentration in the spray fluid.

Chemical tests.—The sample received in 1934 was examined chemically. (Martin, J. T., Occurrence of rotenone in *Tephrosia macropoda* Harv., in *Nature*, **137**, 1075: 1936.) The ether extract amounted to 4.2% of the root. Tephrosal was obtained as a pale yellow oil (0.14% of root) of refractive index 1.485 (17°C.). Rotenone, separated from the ether extract as a complex with carbon tetrachloride, was found to be present to the extent of 0.3–0.4% of the root.

From the biological and chemical results, it is unlikely that, unless considerably improved by selection or breeding, *T. macropoda* would be able to compete with derris root in the European or American markets (see also Martin, *loc. cit.*, and Howes, *loc. cit.*).

***Tephrosia Vogelii* Hk. f.**

This is one of the best known and most widely cultivated of the several species of *Tephrosia* known to have toxic properties or to be used as fish-poisons. It is a much branched, erect, woody shrub up to 2.5–3 metres in height. It is found both wild and in cultivation and is used by natives as a fish-poison more or less throughout tropical Africa. In forest regions of West Tropical Africa it is commonly cultivated in the fields of the riverine peoples for use in stupefying fish. Both the leaves and the pods may be used.

The plant appears to exist in two forms, the one with white and the other with purplish or violet flowers. Apart from this difference in flower colour the two forms are similar morphologically. Throughout East Africa the white-flowered form predominates but in West Africa the purple-flowered form is the one generally met with.

Apart from its use as a fish-poison this species is reputed to have other uses among the natives. In Uganda the dried, powdered leaves are strewn in huts in order to drive away fleas.

Insecticidal properties.—Tattersfield, Gimingham, and Morris (A quantitative examination of the toxicity of *Tephrosia Vogelii* Hk. f., in Ann. Appl. Biol. **12**, 66 : 1925) and Worsley (Insecticidal Properties of some East African Plants, in Ann. Appl. Biol. **21**, 659 : 1934) showed the leaf and seed to be insecticidal. There appeared to be some possibilities of its economic use. The discovery of very potent strains of *Derris* and *Lonchocarpus* species has limited the practical employment of this plant to localities where it is found. Georgi (Note on the ether extract of *Tephrosia Vogelii*, in Malay. Agric. Jour. **25**, 300 : 1937) has pointed out that the amount of the extract is very low compared with that of high-grade *D. elliptica*. The fact that the toxic principles are chiefly concentrated in readily harvested parts of the plant has given an added interest to this plant, and the question has arisen whether varieties exist with an enhanced potency.

Three samples from Uganda were sent by the Imperial Institute to Rothamsted in 1936. One of the samples had purple-coloured flowers. Tested by our usual technique the results given in Table 2 were obtained :

TABLE 2.

Toxicity of the leaf of *Tephrosia Vogelii* to *Aphis rumicis*.

% Concentrations tested in terms of leaf.		% Moribund and Dead Insects.				
		Toro sample Flower colour not given.		Kampala samples.		
				White Flower.	Purple Flower.	
1.0	...	100	...	100	...	100
0.5	...	100	...	100	...	100
0.25	...	25	...	25	...	85
0.1	...	5	...	10	...	5
0.05	...	5	...	5	...	5
Controls	...	0	...	0	...	0

The samples are not sufficiently potent to justify any confidence that they would compete successfully with species of *Derris* and *Lonchocarpus* now firmly established as insecticides in the markets of Europe and America. The leaf of the variety possessing purple-coloured flowers appeared somewhat superior to the other two, but this may be due to chance. The selection of much more potent strains than these would be needed to warrant more than a local use.

Tephrosia sp.

A sample of the root of a legume collected in Arnhem Land, North Australia, by Dr. Donald F. Thompson was tested. It is known to the aborigines as "moiyongo" and reported as a species of *Tephrosia*. Alcoholic extracts showed some toxicity to *Aphis rumicis*. Concentrations in terms of root of 1.0 and 0.1% gave percentage figures of paralysed insects of 90 and 40 respectively. This root might possibly find a local use as an insecticide.

SUMMARY.

The distribution, native uses, and contact insecticidal properties of a number of fish-poisoning plants are described. None is of the same order of effectiveness as *Derris elliptica*. The most interesting from an insecticidal point of view are a vine from the British Solomon Islands, indistinguishable from *Derris trifoliata*, the leaves of which are toxic, *Dolichos pseudopachyrhizus* from Kenya, *Millettia pachycarpa* from India, *Tephrosia macropoda* from Natal and *T. Vogelii* from Uganda.

XXIV—CONTRIBUTIONS TO THE FLORA OF SIAM (THAILAND). ADDITAMENTUM LIII.*

Gaertnera sralensis (*Pierre ex Pitard*) Kerr, comb. nov. (Loganiaceae—Gaertnereae). *Psychotria sralensis* Pierre ex Pitard in Fl. Gén. Ind.-Chin. 3, 344 (1924).

Krat, Kao Kuap, 700–900 m., evergreen forest, Kerr 17764, 17798, *Pit* 2939.

The transference of this species to the genus *Gaertnera* is made on account of its inferior calyx.

Gaertnera taiensis Kerr (Loganiaceae—Gaertnereae); species *G. ramosae* Ridl. affinis, inflorescentia glabra, floribus minoribus praecipue differt.

Frutex vel *arbuscula* usque 5 m. altus, stipulis exceptis omnino glaber, ramulis siccitate nigro-purpureis laevibus teretibus vel subquadrangularibus, ad petioli insertionem callo U-formi notatis. *Folia* oblongo-elliptica vel oblongo-oblancoolata, basi cuneata, apice acute acuminata, 11.5–17.5 cm. longa, 3.2–4.8 cm. lata, chartacea, costa supra prominula subtus prominente, nervis lateralibus 6–8 paribus subtus prominentibus leviter arcuatis marginem versus evanescentibus, nervis transversis subconspicuis; petiolus 1.5–1.9 cm. longus, supra subplanus; stipulae usque ad medium vel ultra connatae, usque 1.5 cm. longae, parte libera apice bifida, pilis brevibus appressis sparse obsitae, deciduae sed parte basali saepe annulatum persistente. *Inflorescentia* terminalis, glabra, paniculato-cymosa, 2.5–4 cm. longa, pedunculo ramulisque valde complanatis; bracteae cito deciduae; pedicelli circiter 1–2 mm. longi. *Calyx*

* Continued from K.B. 1939, 465.

5-dentatus, 0.5 mm. altus, extra glaber, intus basin versus cingulo setarum brevium praeditus. *Corolla* alba; tubus 5 mm. longus, superne sensim ampliatus, extra glaber, intus fauce longe villosus; lobi 3 mm. longi, anguste triangulares, apice inflexi. *Stamina* in fauce inserta, glabra, filamentis circiter 1.75 mm. longis, antheris 2 mm. longis. *Ovarium* glabrum; stylus 6.5 mm. longus, ramis stigmaticis 1.75 mm. longis. *Fructus* didymus vel globosus, circiter 5 mm. diametro.

Trang, Kao Soi Dao, circiter 300 m., in evergreen forest, *Kerr* 19137.

***Canscora hexagona* Kerr** (Gentianaceae-Chironieae); species *C. pentantherae* C. B. Clarke affinis, calycis tubo valde 6-angulato facile distinguenda.

Herba annua, erecta, plus minusve dichotome ramosus, 7–45 cm. alta, omnino glabra; caulis anguste 4-alatus. *Folia* inferiora petiolata, ovato-lanceolata vel ovata, basi late cuneata vel rotundata, apice obtusa, membranacea, usque 7 cm. longa, 4.8 cm. lata, trinervia vel triplinervia; petiolus 3–5 mm. longus, supra concavus; folia superiora sessilia, superne sensim decrescentia, omnia distincta. *Inflorescentia* cymosa, multiflora; bractee anguste ovatae vel lineares, 1–1.5 mm. longae; pedicelli graciles, 2–10 mm. longi. *Calyx* urceolatus, 6-dentatus, scariosus, manifeste reticulato-nervosus; tubus valde 6-angulatus, 5 mm. longus; dentes acuti, mucronati, 1.5 mm. longi. *Corolla* alba, 6-lobata; tubus subcylindricus, superne leviter sensimque ampliatus, 5 mm. longus; lobi aequales, obovati, rotundati, 2 mm. longi, 1.2 mm. lati. *Stamina* 6, aequalia, medio tubi affixa, filamenta 4.8 mm. longa; antherae 1.8 mm. longae, exsertae. *Ovarium* ovoideum, 3 mm. longum; stylus 4.5 mm. longus; stigma bilobatum, lobis subrotundis. *Capsula* circiter 4 mm. longa, siccitate rugosa, bivalvis, secundum suturas dehiscens; semina ovoidea, minute rugulosa, 0.3 mm. longa.

Korat, Chan Tuk, circiter 300 m., edge of savannah, *Kerr* 8059.

***Gentiana* (§ *Chondrophylla*) *arenicola* Kerr** (Gentianaceae-Swertieae); species *G. capitatae* Buch.-Ham. affinis, calyce corollae aequilongo, calycis lobis obtusis differt.

Herba annua, erecta, glabra, simplex vel corymboso-ramosa, 7–11 cm. alta, caule siccitate longitudinaliter striatula et minute purpureo-punctato, internodiis usque 2 cm. longis. *Folia* intervallis aequalibus secundum caulem ordinata, sessilia vel brevissime petiolata, oblongo-obovata, basin versus sensim attenuata, apice obtusa, margine minutissime parceque ciliata, haud hyalina, 1.8–2.2 cm. longa, 0.7–1.0 cm. lata. *Inflorescentia* terminalis, subcapitata, 4–20-flora, foliis superioribus cum bracteis pseudo-involucrum efformantibus; bractee spathulatae, apice rotundatae mucronataeque, scariosae nisi apicem versus viridulae, 3-nerviae, usque 1.6 cm. longae, 0.5 cm. latae. *Calyx* corollae ± aequilongus; tubus 5–8 mm. longus, scariosus; lobi oblongi vel oblongo-spathulati

apice rotundati apiculatique, 5·5–7 mm. longi, 2–3 mm. lati, 1-nervii, scariosi nisi apicem versus viriduli. *Corolla* infundibuliformis, circiter 14 mm. longa; tubus circiter 11·5 mm. longus; lobi triangulares, circiter 2·5 mm. longi; plicae triangulares, obtusae, lobis duplo breviores. *Stamina* aequalia, 3 mm. supra basin corollae tubi affixa; filamenta circiter 5 mm. longa, basin versus sensim dilatata; antherae 2 mm. longae. *Capsula* matura e corolla vix exserta, obovoidea, 15 mm. longa, stipite 5 mm. longo incluso, apice alata, alis dentatis; semina ellipsoidea, utrinque apiculata, fusca, longitudinaliter leviter rugosa, circiter 1·2 mm. longa.

Sakon, Wanawn, circiter 200 m., open grassy deciduous forest, *Kerr* 8493.

The specific name refers to the sandy soil of the forests of Eastern Thailand where this plant grows, evidence of which is manifest on the roots of the dried material.

***Gentiana Lakshnakarae* Kerr** (Gentianaceae–Swertieae); species *G. Hesselianae* Hoss. affinis, habitu nano, foliis pro rata angustioribus valde diversa.

Herba annua, 3–5 cm. alta; caulis brevis, 1–2 cm. altus, simplex vel pauciramosus. *Folia* rosularia, sessilia vel subsessilia, plana, anguste elliptica vel lanceolata, basin et apicem versus sensim attenuata, apice mucronata, margine haud vel vix hyalina leviter asperula, nervis obscuris, usque 5 cm. longa, 1·6 cm. lata. *Flores* sessiles, caerulei, 2–8 in apicibus caulis et ramulorum dispositi. *Calycis* tubus membranaceus, 5–6·5 mm. longus; lobi ovati, longe aristati, basin versus membranaceus, 4·5–5·5 mm. longi, basi 1·5 mm. lati, margine minute parceque asperuli. *Corollae* tubus circiter 13 mm. longus; lobi ovati, mucronati, circiter 3 mm. longi; plicae lobis duplo breviores, triangulares, apice minute apiculatae. *Stamina* aequilonga, 4·5 mm. supra basin tubi inserta; filamenta circiter 4·3 mm. longa, basin versus leviter dilatata; antherae circiter 2·5 mm. longae. *Capsula* obovata, dimidio superiore satis alte alata, stylo perbrevis, stigmatibus recurvatis 3–4 mm. longis, stipite excluso circiter 5 mm. longa, primo breviter stipitata, denique stipite 9 mm. longo suffulta. *Semina* fusca, ellipsoidea, utrinque apiculata, minute striatula, circiter 0·75 mm. longa.

Loi, Kao Krading, circiter 1200 m., open pine forest, *Lakshnakara* 1392, *Kerr* 8697A (*type*).

***Gentiana* (§ *Chondrophylla*) *timida* Kerr** (Gentianaceae–Swertieae); species *G. capitatae* var. *Andersonii* C. B. Clarke et *G. cephalodi* Edgew. affinis, ab ambabus tota planta multo minore, calycis lobis pro rata brevioribus distinguenda.

Herba annua, erecta, simplex, circiter 2·8–6·5 cm. alta; caulis gracilis, teres vel subquadratus, minute papillosus, apicem versus scabridulus. *Folia* basalia 0; caulina 4–6, caulis apicem versus aggregata, sessilia, late elliptica vel oblanceolata, apice subacuta,

minute mucronata, margine anguste hyalina et minute ciliata, 6×3.4 – 11×6 mm. magna, glabra, trinervia. *Flores* 3–6 in apice caulis aggregati, sessiles vel brevissime pedicellati, 9–12 mm. longi, caerulei. *Calycis* tubus c. 2 mm. longus; lobi erecti, longe aristati, 3 mm. longi, margine hyalini. *Corollae* tubus 6.5–8.5 mm. longus; lobi ovati, apiculati, circiter 1.5 mm. longi; plicae leviter bifidae, lobis duplo breviores. *Stamina* aequalia vel subaequalia; filamenta circiter 3 mm. longa; antherae 1 mm. longae. *Capsula* matura e corolla leviter exserta, obovata, dimidio superiore anguste alata, longe stipitata, stipite 7–9.5 mm. longo; semina ellipsoidea, leviter rugulosa, fusca, circiter 1 mm. longa.

Doi Sutep, 1500 m., among grass in open forest, *Kerr* 1579B.

The specific name of this small plant refers to its habit. It is usually more or less hidden by the grass among which it grows, and seldom expands its flowers.

***Swertia* (§ *Ophelia*) *calcicola* Kerr** (Gentianaceae–Swertieae); species *S. bellae* Hemsl. affinis, floribus minoribus saepius 5-meris, corollae glandulis angustioribus longius fimbriatis distinguenda.

Herba annua, erecta, glabra, leviter ramosa, 8–20 cm. alta; caulis leviter quadrialatus. *Folia* sessilia vel brevissime petiolata, lanceolata vel elliptica, apice apiculata, usque 2.5 cm. longa, 0.8 cm. lata. *Flores* saepius 5-meri, rarius 4-meri, longe pedicellati, pedicellis vulgo plus minusve curvatis 1.5–3.5 cm. longis. *Calyx* usque ad basin 5-fidus; lobi sub anthesi elliptici, apice acute apiculati, circiter 5 mm. longi, 1.5 mm. lati, cito accrescentes, demum late lanceolati, usque 13 mm. longi, 5.5 mm. lati. *Corolla* alba, purpureo-nervosa, accrescens; tubus sub anthesi 1 mm. longus; lobi subrhombiformes, 9 mm. longi, 3 mm. lati, apice acute apiculati, basi intus glandulis oblongis binis squamulis apice longe fimbriatis obtectis praediti. *Stamina* distincta, in corollae tubo inserta; filamenta circiter 4 mm. longa, basi vix dilatata; antherae circiter 1 mm. longae. *Ovarium* circiter 7 mm. altum; stigma sessile, bilobum. *Semina* ovoidea, minute foveolata, circiter 0.5–0.7 mm. diametro.

Doi Chiengdao, 2000–2100 m., on rocks (limestone), *Kerr* 6543.

***Swertia* (§ *Ophelia*) *pinetorum* Kerr** (Gentianaceae–Swertieae); *S. striatae* Coll. et Hemsl. affinis, foliis minoribus, corollae lobis obovatis distinguitur.

Herba annua, erecta, glabra, 10–25 cm. alta, plus minusve ramosa; caulis quadrangularis, foliosus; rami ascendentes. *Folia* sessilia, lanceolata vel elliptica, 3-nervia, caulis parte inferiore circiter 1.5–2 cm. longa, 0.7–0.9 mm. lata, sursum decrescentia. *Flores* 5-meri, rarius 4-meri; pedicelli 1–2.5 cm. longi. *Calyx* usque ad basin 5-fidus; lobi lanceolati, acuti, 3-nervii, circiter 5 mm. longi, basi 1.5 mm. lati. *Corolla* alba, violaceo-striata (ex *Garrett*), circiter 1.8 cm. diametro; lobi obovati, apiculati, circiter 9.5 mm. longi, 5.5 mm. lati, basi glandulis binis oblongis ore fimbriatis praediti;

tubus circiter 1.5 mm. longus. *Stamina* distincta; filamenta circiter 4.3 mm. longa; antherae 2 mm. longae. *Ovarium* 6 mm. altum; stigma sessile, bilobum. *Semina* plus minusve rotunda, leviter complanata, minute foveolata, 0.5 mm. diametro.

Chawm Tawng, Doi Dawk, circiter 1780 m., open grassy land under pine, *Garrett* 619.

Nymphoides siamensis (*Ostenf.*) *Kerr* (Gentianaceae—Menyantheae), comb. nov., descr. emend. et ampl.—*Limnanthemum indicum* var. *siamense* *Ostenf.* in *Bot. Tidsskr.* **24**, 263 (1902).

Herba glabra. *Folia* natantia, ambitu late ovata, basi alte cordata; petiolus 1–4 cm. longus. *Inflorescentia* 2–20-flora. *Flores* albi, 5-meri. *Calyx* alte 5-fidus; lobi oblongo-lanceolati, acuti, 3-nervi, 6 mm. longi, 1.7 mm. lati. *Corollae* tubus calyce brevior. *Stamina* medio tubo inserta; antherae circiter 1.5 mm. longae. *Nectaria* 5, parva, lobata, ad ovarii basin affixa. *Ovarium* ovoideum, circiter 2.5 mm. altum; stylus circiter 4.5 mm. longus; lobi stigmatici 2–3, ovati, circiter 1.5 mm. longi. *Capsula* calycem vix excedens, circiter 4–6-sperma; semina lenticularia, leviter muricata, circiter 1.2 mm. diametro.

Krat, Kao Saming, under 20 m. alt., in shallow pond, *Kerr* 9432; Satul, Tola, circiter 50 m., in muddy pond, *Kerr* 13865.

The above amplified description is chiefly taken from *Kerr* 9432, which comes from a locality near that of Schmidt's collection, on which *Ostenfeld* based his var. *siamense*. The description of the fruit and seed is from *Kerr* 13865. *Ostenfeld* recognised that his variety differed considerably from *N. indica*, but, his material being poor, refrained from giving it specific rank. The further material now available amply warrants its recognition as a species quite distinct from *N. indica*. Probably in this, as in some other species of *Nymphoides*, the flowers are dimorphic, in which case the above description applies to the long-styled form.

Cordia Mhaya *Kerr* (Boraginaceae—Cordiaceae); species *C. obliquae* Willd. affinis, foliis acuminatis supra minute albo-punctatis distinguatur.

Arbor, ramulis teretibus cortice pallide cinereo lenticellis parvis ovalibus pallidis consperso obtectis, innovationibus brunneo-tomentosis cito glabrescentibus. *Folia* coriacea, supra minute albo-punctata, glabra nisi subtus secundum costam et nervos laterales pilis paucis brevibus conspersa, ovata vel late elliptica, basi rotundata vel subcordata, rarius late cuneata, apice abrupte acuminata, margine integra vel repando-crenata, penninervia, costa cum nervis lateralibus subtus prominente supra leviter convexa, nervis lateralibus 5–8 paribus patentibus fere rectis prope marginem anastomosantibus, nervis transversis et rete venularum supra modice subtus valde prominulis, usque 16 cm. longa, 10.5 cm. lata; petiolus 4–5.5 cm. longus, glaber, supra alte concavus. *Inflorescentia* lateralis, cymosa, usque 15 cm. longa. *Calyx* circiter 6 mm. longus,

inaequaliter 2-3-lobatus, extra glaber, intus dense villosus. *Corollae* tubus circiter 4 mm. longus ; lobi 5, reflexi, oblongi, obtusi, circiter 6 mm. longi. *Stamina* 5, corollae fauci inserta ; filamenta basin versus sat dense pilosa. Cetera ignota.

BURMA : Pegu, *Kurz* (401) 2345 (type). THAILAND : Kanburi, Wangka, c. 200 m., lofty tree in bamboo forest, *Kerr* 10300.

Kurz, *For. Fl. Burma*, 2, 208, in a note after *C. Myxa*, states : " There is another species of *Cordia* (apparently) of which only the leaves are known. These leaves are largely employed by the Burmese for cigar-envelopes. It is called 'mhaya,' and is said to grow abundantly in the Pegu Yomah." In Kew Herbarium there is a sheet of *Cordia* with a Kurz label, on which appears the number (401) 2345, the name *Cordia Myxa* L. and the locality Pegu. The first number has been crossed through and the second added. It is necessary to note this, as there is another sheet, of probably a different species, with the number (395) 2345. To the first sheet Brandis has attached the following observation : " This I identify with the species mentioned by Kurz on p. 208, F.Fl.II, as Mhaya, largely employed as covering leaves for the large Burman cheroots. From *C. Myxa* it differs by longer petioles, adult leaves minutely hairy beneath, rough above with minute cystolith cells. June 1903. D.B." In his *Indian Trees*, 479 (1906), Brandis further refers to this species, giving a short description of the leaves and adding that it is a small tree, but refrains from giving it a name. Kurz says nothing about the size of the tree. Kurz's specimen consists of a branch with several leaves. Some loose male flowers are in a capsule attached to the sheet. The Thai collection agrees very closely with Kurz's, as far as the material goes. It carries inflorescences just coming into flower ; but here again all the flowers are male. They agree well with the loose flowers in the capsule of the Kurz sheet. The above description has been drawn up chiefly from the Kurz sheet, that of the inflorescence being taken from the Thai material.

***Tournefortia intonsa* Kerr** (Boraginaceae-Heliotropieae) ; species affinis *T. Roxburghii* C. B. Clarke et *T. Wightii* C. B. Clarke, ab ambabus foliis majoribus basi cuneatis, nervis lateralibus patentioribus distinguitur ; necnon a *T. ovata* Wall. foliis densius tomentosis, floribus confertioribus recedit.—*T. ovata* Craib in *Kew Bull.* 1911, 422, non Wall.

Frutex scandens, ramulis striatis fulvo-tomentosis. *Folia* oblongo-elliptica vel oblongo-lanceolata, basi anguste cuneata, apice sensim attenuata, acuta, margine integra, chartacea, supra pilis brevibus adpressis parce hirsuta, subtus sat dense tomentosa, usque 18 cm. longa, 6 cm. lata, supra costa cum nervis lateralibus leviter impressa, subtus prominula, nervis transversis supra obscuris subtus subconspicuis, nervis lateralibus 8-10 paribus angulo 45° e costa arcuato-ascendentibus ; petiolus 0.7-1.2 cm. longus, dense tomentosus. *Inflorescentia* terminalis, vel ramulos breves laterales terminans, fulvo-tomentosa ; pedunculus 4-9 cm.

longus; rami saepius iterum ramosi; spicae dense multiflorae, 12–25 mm. longae. Flores pallide virides, sessiles. Calyx 5-fidus; lobi anguste triangulares, acuti, extra intusque dense tomentosi, circiter 1.5 mm. longi. Corollae tubus circiter 10 mm. longus, inferne leviter ampliatus, extra tomentosus, intus glaber; lobi 5, rotundati, circiter 1.5 mm. longi. Stamina circiter 3 mm. supra basin tubi inserta; antherae lineares, minute apiculatae, circiter 2 mm. longae; filamenta circiter 0.5 mm. longa. Ovarium circiter 1.5 mm. altum; stigma sessile, bilobum.

Doi Suteh, c. 900 m., evergreen forest, *Kerr* 2285 (type); Ban Me Ta (between Lampang and Pre), near stream, *Kerr* 997.

XXV—CONTRIBUTIONS TO THE FLORA OF BURMA: XVII.*

The regions in brackets after the specific epithet are those from which the species has been reported previously.

Polygala trichophylla Chodat [Polygalaceae] (E. Himalayas in India).

Nam Hat Valley, 27°35'N., 97°55'E., 1850 m., fls. Sept., *F. Kingdon Ward* 7381: "Liana in upper forest of Oak, Rhododendron, etc. Calyx and reflexed standard purple, keel and wings bright yellow." Moulmein, *Lobb*, without information. Thaton District: Dawna Range, west side, frt. Feb., *J. H. Lace* 6336.

Anisadenia saxatilis Griff. [Linaceae] (Nepal to Assam).

Nam Tamai Valley, 27°45'N., 97°55'E., 1550–1850 m., fls. Aug., *Ward* 7318: "Epiphyte in the forest. Fls. white." N. E. Upper Burma, 3000 m., fls. Sept., *G. Forrest* 24918.

Fagara oxyphylla (Edgew.) Engl. [Rutaceae] (Himalayas from Garhwal to Khasia, W. China).

Seinghku Wang, 2000 m., fls. May, *Ward* 6745: "Scrambling up many feet through thickets. Fls. dull-purple with conspicuous bright-yellow anthers; seeds black, polished, like small shot. Whole plant strongly aromatic."

Apios carnosa (Wall.) Benth. ex Baker [Papilionaceae] (Nepal to Khasia).

Zayul Valley, Kahao, 2150 m., fls. July, *Ward* 7167: "Twinner in thickets in Pine Forest. Fls. red." Ruby Mines District: Kabaing to Kathpyin, 900–1200 m., fls. Oct., *Lace* 5992.

Desmodium podocarpum DC. [Papilionaceae] (Simla to Khasia, China, Japan).

Zayul valley, Kahao, 1550 m., fls. July, *Ward* 7157: "In woods. Tall, slender shrub with drooping branches. Fls. pale-pinkish-purple."

* Continued from K.B. 1939, 337.

Millettia Dielsiana Harms [Papilionaceae] (W. China).

Zayul valley, Kahao, 1500 m., fls. July, *Ward* 7153: "Large twiner, spreading over rocks and shrubs in rocky ravines on pine-clad slopes; fls. a sort of raw-meat purple or crimson."

Rhynchosia himalensis Benth. ex Baker [Papilionaceae] (India, Himalayas).

Zayul Valley, Kahao, 1500 m., fls. July, *Ward* 7156: "Twiner in open pastures and rocky places forming low massive growths; fls. yellow, standard heavily veined with purple."

Fragaria nubicola Lindl. [Rosaceae] (Himalayas as far East as Sikkim).

Seinghku Wang, 28°8'N., 97°24'E., 3400 m., fls. June, *Ward* 6919: "In open pastures and on boulders. Fls. white."

Maddenia hypoxantha Koehne [Rosaceae] (W. China).

Seinghku Wang, 3100 m., fls. early June, *Ward* 6811: "Small shrub in thickets or in the open on steep faces. Fls. white, very fragrant."

Neillia thyrsiflora Don [Rosaceae] (Central and Eastern Indian Himalayas, China, Java).

Seinghku Valley, 1200–1500 m., fls. Aug., *Ward* 7278: "Lax shrub 6–10 ft. high, sending up many branches which droop over. In thickets and open places at edges of the forest. Fls. white."

Potentilla peduncularis Don [Rosaceae] (Himalayas as far East as Sikkim).

Seinghku Valley, 28°10'N., 97°20'E., 3400 m., fls. Oct., *Ward* 7595: "Scattered on sunny turf or grit slopes. Fls. golden-yellow."

Prunus rufa Wall. [Rosaceae] (Nepal to Bhutan).

Seinghku Wang, 28°8'N., 97°24'E., 3400 m., fls. June, *Ward* 6949. "Small, spreading shrub, branches expanding horizontally. In thickets amongst boulders in the valley. Fls. pale-pink, hanging from the flattened branches." 2750–3100 m., fls. early June, *Ward* 6983: "6–10 m. high. In thickets and on meadow-clad slopes. Fls. white."

Rosa sericea Lindl. [Rosaceae] (Kumaon to Bhutan, W. China).

Seinghku Wang, 28°8'N., 97°24'E., 3400–3700 m., fls. July, *Ward* 7035: "Dwarf shrub, more or less prostrate, branches ascending, compact. On sloping granite rocks in thickets of dwarf Rhododendron. Fls. pale-sulphur, anthers cream, stigmas golden."

Rubus eustephanos Focke [Rosaceae] (W. China).

Nam Tamai, 1200–1500 m., fls. and young frt. early May, *Ward* 6690: "In thickets of secondary, mostly scrub jungle on old cultivated slopes. Small, spreading, scrambling bush. Stems red; fls. pure-white, slightly fragrant."

Rubus Hookeri Focke [Rosaceae] (Sikkim).

Seinghku Wang, 2300 m., fls. end May, *Ward* 6778: "On steep, stony slopes on the edge of the 'dry' forests (i.e., facing the sun) or in thickets in open shaded situations. Undershrub, more or less prostrate and ascending. Fls. large, nodding, cream."

Sorbus Rehderiana Koehne [Pomaceae] (W. China).

Seinghku Wang, 28°8'N., 97°24'E., 3700–4000 m., fls. July, *Ward* 7095: "Shrub 2.5–3.5 m. high, growing among Rhododendrons on the more sheltered slopes. Leaves polished. Fls. white unpleasantly scented."

Sorbus ursina Wenz. [Pomaceae] (Kumaon to Sikkim).

Seinghku Wang, 3100 m., fls. early May, *Ward* 8658: "Small tree in tanglewood and open thickets. Fls. dull-red."

Leptodermis Wardii C. E. C. Fischer et K. N. Kaul, sp. nov. [Rubiaceae]; *L. Potanini* Batal. similis, sed foliis adultis rigidis glabris (nervis supra hispidis exceptis) reticulationibus obscuris, stipulis rigidis longitudine sua latioribus a petiolis liberis, corollis extra glabris, antherarum filamentis longioribus.

A bushy *undershrub* about 33 cm. high; stems up to 4 mm. diam., greyish and glabrous below, with 2 lines of hispid pubescence and often reddish above; lower internodes up to 5 cm. long, upper much shorter. *Leaves* rigid, elliptic to broadly ovate, acute at both ends, 1.2–4.1 cm. long, 0.6–2.4 cm. wide, dark-brown (when dry) above, pale below, glabrous except the hispid midrib and the 3–4 pairs of primary nerves above, more pronounced when young, reticulations obscure, margins ciliate; petioles 1–5 mm. long, hispidulous above; stipules rigid, free from the petioles. *Inflorescence* terminal on the branchlets and axillary in the upper leaves; flowers solitary or a few fascicled; pedicels 0–2 mm. long; bracts united in a short sheath round the pedicels, the free ends broadly ovate or broader than long, acute, with a sharp tooth on either side a little below the ciliate apex, keeled, 2 mm. long; bracteoles 2 at the base of the ovary, resembling the bracts but much smaller. *Calyx-tube* and ovary obconic, 2.5–3 mm. long, glabrous, blackish when dry; tube above the ovary very short; lobes 5 (rarely 6), triangular-lanceolate, acute, 1 mm. long. *Corolla-tube* narrowly funnel-shaped, straight or slightly curved, 7.5–8.5 mm. long, glabrous without, crisped-hairy above the middle within; lobes 5, induplicate-valvate, shortly decurrent on the tube, lanceolate to ovate, acute, 2.5 mm. long, minutely puberulous at the tip without, beset with thickish white hairs within. *Stamens* 5, inserted above the middle of the corolla-tube; filaments slender, 1.6 mm. long, glabrous; anthers linear, 2.6–2.9 mm. long, dorsifixed, half exserted. *Ovary* 4–5-celled, crown flat; style slender, 4–4.5 mm. long, glabrous, stigmas 3–5, filiform, papillose, about reaching the base of the filaments. *Fruit* not seen.

Seinghku Valley, 28°5'N., 97°30'E., 2770 m., fls. Oct., *Ward* 7610: "Forming compact clumps on limestone cliffs facing south on the open ridge. Fls. cream, slightly fragrant."

Codonopsis Benthami *Hook. f.* [Campanulaceae] (Sikkim).

Di Chu Valley, 3400 m., fls. end July, *Ward* 7193: "Erect or weakly twining, 1 m. or more long. Often in clumps in meadows. Fls. bright-yellow, base finely purple-speckled, ovary and style purple-black; fragrant." Seinghku Valley, 28°10'N., 97°20'E., 4000 m., fls. and frt. early Oct., *Ward* 7531: "On steep grass slopes, semi-erect or ascending or lying along the slopes in clumps or singly; abundant. Fls. pale greenish-yellow, purple-speckled at the base within."

Lonicera chlamydata *W. W. Sm.* [Caprifoliaceae] (Yunnan).

Seinghku Wang, 28°8'N., 97°24'E., 3400 m., fls. June, *Ward* 6906: "Spreading, 1 m. or less high, sometimes forming a thick bush. On or amongst boulders on steep slopes. In thickets of shrubs or solitary. Fls. rather dull-yellow; berries translucent blood-red."

Lonicera hispida *Pall. ex Roem. et Schult.* [Caprifoliaceae] (Central Asia, Kashmir to Sikkim, China).

Seinghku Wang, 28°8'N., 97°24'E., 3400–3700 m., fls. June, *Ward* 6946: "1 m. or less high, branches outspread. In thickets on boulder slopes beneath *Abies* forest on the sheltered slope of the valley. Fls. yellow; berries glaucous blue." The specimens are not typical of the species.

Lonicera Myrtilus *Hook. f. et T.* [Caprifoliaceae] (Kashmir to Sikkim).

Seinghku Wang, 28°8'N., 97°24'E., 3400 m., fls. June, *Ward* 6973: "Almost prostrate, spreading shrub growing over boulders in the open valley. Fls. purple-rose."

Lonicera trichosantha *Bur. et Franch.* [Caprifoliaceae] (W. China).

Di Chu Valley, 3100–3400 m., fls. July, *Ward* 7127: "Large, spreading bush. Fls. cream when first open, changing to a deeper yellow with age; berries bright translucent orange."

Hoya erythrostemma *Kerr* [Asclepiadaceae] (Siam).

S. Tenasserim, Thebyu Chaung, 65 m., fls. Feb., *C. E. Parkinson* 1680: "Climber. Juice milky; fls. white to mauve."

Centranthera grandiflora *Benth.* [Scrophulariaceae] (Sikkim, Assam).

Zayul Valley, Kahao, 1850 m., fls. July, *Ward* 7165: "Only seen on the upper pine- and bracken-clad terraces; fairly abundant. Roots orange; fls. bright-yellow."

Pedicularis diffusa *Prain* [Scrophulariaceae] (Sikkim).

Seinghku Wang, 28°8'N., 97°24'E., 3400 m., fls. early July, *Ward* 7028: "In pastures by streams. Fls. pinkish-purple."

Pedicularis Elwesii Hook. f. [Scrophulariaceae] (Sikkim, Yunnan).

Seinghku Wang, 28°8'N., 97°24'E., 3400 m., fls. early July, *Ward* 7027: "In open pastures on mossy boulders, etc. Fls. rich purple."

Pedicularis nana C. E. C. Fischer, sp. nov. [Scrophulariaceae]; a *P. collata* Prain caule verticillo foliorum 4-5 supra bina basalia instructo, foliis pedicellis floribusque brevioribus, corolla intus glabra, labii marginibus denticulatis, galea margine integra differt.

A diminutive, caespitose herb; roots fibrous; stems slender, 1-3 cm. long, glabrous below, more or less pubescent upwards. *Leaves* few, a basal opposite pair a little above the base and a whorl of 4-5 higher up, usually above the middle; blade subcircular, oblong or linear-oblong in outline, 4-6 mm. long, 2-4 mm. wide, pinnatifid into 3-4 pairs of rotund to ovate thick segments with lobulate margins; petioles slender, 6-12 mm. long. *Racemes* terminal, subcapitate, few-flowered; bracts like the leaves but shorter and with wider, 1-costate petioles; pedicels 2-3 mm. long. *Calyx* tubular-campanulate, slightly oblique at the base, sparingly villous without; tube entire, thinly membranous, 4-5 mm. long, with 10 dark veins; lobes 5, subequal, oblong, obtuse, 1-5 mm. long, somewhat thickened and dark at the apex. *Corolla* crimson; tube cylindric, slightly widened at the mouth, 1-1 cm. long, 15-veined below; lip reniform in outline, 5-5 mm. long, 8-5 mm. wide, 3-lobed, apical margins denticulate, midlobe rounded, 2-4 mm. long, lateral rotund-oblong, 3-7 mm. long; galea erect, 4-5 mm. long. *Stamens* inserted near the base of the corolla; filaments narrowly strap-shaped, 1-costate, glabrous, one pair slightly longer than the other; anthers broadly ovate, 1-5 mm. long, base of cells acute. *Ovary* sessile, ellipsoid, 1-5 mm. long; style filiform, stigma globose, hardly exserted. *Capsules* (of previous year and devoid of seed) oblong-lanceolate, acuminate, 6-5 mm. long.

Seinghku Wang, 28°8'N., 97°24'E., fls. July, *Ward* 7093A: "On grassy ledges of limestone cliffs, embedded with other species of *Pedicularis* and mosses in mats of dwarf *Salix*."

Pedicularis Pantlingii Prain [Scrophulariaceae] (Nepal, Sikkim).

Seinghku Wang, 28°8'N., 97°24'E., 2150 m., fls. and young frt. end May, *Ward* 6772: "In alder copse. Fls. pinkish-purple with darker veins." 2900 m., fls. early June, *Ward* 6895: "On meadow slopes in the open." 3400 m., fls. late June, *Ward* 6999: "On steep earth banks. Fls. pale purplish-pink."

Pedicularis rotundifolia C. E. C. Fischer sp. nov. [Scrophulariaceae]; *P. sabaënsi* Bonati affinis, sed foliis bracteisque brevioribus subcircularibus flabellatim lobatis, calyce brevioris haud translucens, labii marginibus integris differt.

A low herb; rootstock slender, fusiform; stems several, woody, slender, terete, slightly sulcate near the apex, 10-15 cm. long, with

two lines of pubescence below and at the apex, glabrous in the middle, internodes long. *Leaves*: radical not seen; cauline opposite, 2 pairs, circular or slightly broader than long, 4–7 mm. diam., the upper the larger, shallowly 8–10-lobed, lobes oblong or flabellate, bluntly 3-lobiculate and these again often bluntly, rarely acutely, 2-lobed, veins obscure, furfuraceous hairy on both faces; petioles 0 or very short. *Inflorescence* terminal in congested or slightly lax heads; bracts like the leaves; pedicels very short. *Calyx* tubular; tube entire, 4–5 mm. long, villous without; lobes 5, posterior ensiform, acute, 1.5 mm. long, the others rotund, subequal, coarsely crenate, 2 mm. diam., pubescent on both sides. *Corolla* crimson; tube slender, 1.07–1.3 cm. long, sparingly puberulous without; lip broadly ovate, 7.5 mm. long, 6.7 mm. wide, 3-lobed, midlobe oblong, 3.5 mm. long, lateral semicircular, 3–5 mm. diam.; galea glabrous, bent at right angles, slightly swollen at the bend, erect portion 3.5–4.5 mm. long, beak straight or slightly curved, 6.2–7.2 mm. long, apex entire, truncate. *Stamens* inserted above the middle of the corolla-tube; filaments filiform, glabrous; anthers elliptic-oblong, 2 mm. long. *Ovary* sessile, ellipsoid, 2.5 mm. long; style filiform; stigma capitate. *Fruit* not seen.

Seinghku Valley, 3380 m., fls. late July, *Ward* 7216: "In pastures and meadows."

***Briggsia muscicola* (Diels) Craib** [Gesneriaceae] (Yunnan).

Di Chu Valley, 2770 m., fls. July, *Ward* 7135: "On mossy tree-trunks in mixed forest. Fls. egg-yellow finely mottled with red-brown."

***Ficus nemoralis* Wall.** [Moraceae] (Indian Himalayas).

Seinghku Wang, 1540 m., young receptacles May, *Ward* 6723: "Medium-sized, spreading tree, common but confined to the jungle by the river. Usually laden with epiphytes and often hanging over the river. One of the very few species of *Ficus* at this altitude."

***Larix Griffithii* Hook. f. et Thoms.** [Coniferae] (Nepal to Bhutan.)

Di Chu Valley, 3400–3700 m., cones end July, *Ward* 7191: "Tall, graceful tree on the steep granite cliffs and flanks of the valley, with *Abies*; nowhere forming forests by itself. Much more abundant on the North side of the snow range than on the Burma side, where it is rare."

***Iris kumaonensis* Wall.** [Iridaceae] (Kashmir to Kumaon).

Seinghku Wang, 28°8'N., 97°24'E. 3400–3700 m., fls. June, seeds Oct., *Ward* 6917: "In tight dwarf clumps on steep grassy banks amongst *Rhododendron* bushes. Falls rich gleaming purple, standards white with a purple band down the centre, beard yellow; fragrant."

***Allium Wallichii* Kunth** [Liliaceae] (Gilgit to Sikkim).

Seinghku Valley, 28°10'N., 97°20'E., 3400–3700 m., fls. Oct., *Ward* 7554: "In alpine meadow. Fls. purple." 28°8'N., 97°25'E.,

3100-3400 m. fls. late Sept., Ward 7517: "On steep meadow slopes beneath the cliffs, 60-100 cm. high; fls. mauve; whole plant strongly scented."

XXVI—ADDITIONS TO THE FLORA OF BORNEO AND OTHER MALAY ISLANDS: XVII.*

TWO NEW BORNEAN RUBIACEAE. C. E. B. BREMEKAMP.

Lecariocalyx Bremek., gen. nov. *Psychotriearum*, inflorescentia terminali una cum endospermo ruminato ad *Grumileam* Gaertn. et ad *Peripelum* Pierre accedens, calyce rotato, fructu accrescente ab iis recedens.

Rami novelli et *folia* infra pilis septatis vestita. *Stipulae* in vaginam ampliorem connatae, lobis interpetiolaribus apice in aristas duas exeuntibus. *Inflorescentia* terminalis, sed ope ramuli axillaris mox in positionem lateralem coacta, pedunculata, capitata vel e capitulis pluribus composita; bracteae angustae, ciliatae; bracteolae nullae. *Flores* hermaphroditi, 4- vel 5-meri, forsitan heterostyli. *Ovarium* biloculare; ovula in quoque loculo solitaria, ascendencia. *Calyx* rotatus, lobis ovatis vel ovato-orbicularibus trinerviis magnis. *Corolla* hypocrateriformis, tubo os versus tamen paulum dilatato fauce dense sericeo-villoso, lobis aestivatione valvatis. *Stamina* in corollae fauce inserta, antheris basifixis introrsis. *Discus* semiglobosus, sulcatus. *Stylus* filiformis; stigmata 2, oblonga, brevia. *Fructus* drupaceus, calyce accrescente coronatus, subcostatus, bipyrenus. *Semina* endospermo ruminato praedita, embryone parvo.

Genus adhuc monotypicum terrae Borneënsis partem occidentalem habitans

Lecariocalyx borneënsis Bremek., sp. nov. (unica).

Habitus ignotus. *Rami novelli* teretes, 2.5 mm. diametro, dense hirtello-tomentosi. *Folia* petiolo dense hirtello-tomentoso 2-4 mm. longo suffulta; lamina elliptica vel obovata, 5-6.5 cm. longa, 2-2.7 cm. lata, apice longius acuminata, basi acuta et haud raro conduplicata, subcoriacea, siccitate supra saturate et subtus dilute brunnea, supra glaberrima, subtus costa nervisque dense hirtello-tomentosa, inter nervos sparse et fugaciter pilosa et minute albidolepidota, costa subtus crassa valde prominente, nervis utroque latere costae 8-9 supra immersis subtus prominulis, venulis paucis. *Stipulae* in vaginam 4 mm. altam connatae, lobis late triangularibus 5 mm. latis 1 mm. altis, aristis gemellis 1.5 mm. longis, extra sparse hirtellae, basin versus glabrescentes, axilla sericeae. *Inflorescentia* pedunculo dense hirtello-tomentoso 2.7-3.0 cm. longo elata, nunc e capitulo singulo, nunc trichotome ramificata et e capitulis tribus formata, in quo casu ramuli 1 cm. longi foliis lineari-lanceolatis 3 cm. longis suffulti; capitula 1.7-2.0 cm. diametro, basi foliis linearibus

* Continued from K.B. 1939, 545.

1.3–2.0 cm. longis suffulta; flores dichasialiter dispositi, bracteis linearibus margine graciliter ciliatis extra basin versus hirtello-tomentosis costa hirtellis suffulti. *Flores* alii 4-meri, alii 5-meri. *Ovarium* turbinatum, extra dense et longe sericeum. *Calycis* tubus late infundibuliformis, 1–1.5 mm. altus, 1.4 mm. diametro, intus sericeo-villosus; lobi 4, aequales, vel 5, nunc aequales, nunc inaequales, 4 mm. longi, 3.5 mm. lati, extra sparse hirtelli, margine subpellucide ciliati, intus glabri. *Corollae* tubus 4.5 mm. longus, basi 1.2 mm., fauce 1.6 mm. diametro, extra glaber; lobi oblongi, 2.5 mm. longi, 0.9 mm. lati, apice acuto incurvati, extra apice hirtelli, intus glabri. *Stamina* filamentis glabris 2 mm. longis exserta; antherae oblongae, obtusae, 1 mm. longae. *Discus* glaber. *Stylus* glaber, 4.5 mm. longus; stigmata 0.5 mm. longa, subinclusa. *Drupa* hirtello-tomentosa, calyce ad magnitudinem duplam aucto coronata.

SARAWAK. Sine loc., *Native Collector* (*Sarawak Museum*) 1362 (typus, Herb. Kew.).

The difference in height between the anthers and the stigmata suggests heterostyly, a condition not uncommon among the *Psychotrieae*.

Gaertnera schizocalyx *Bremek.*, sp. nov., a congeneribus omnibus calyce in lobos lineares partito conspicue diversa; inflorescentia hirtella et congesta etiam facile cognoscenda.

Habitus ignotus. *Rami novelli* pilis incurvatis dense griseo-villosi, deinde glabrescentes et mox cortice albido vestiti, teretes. *Folia* petiolo supra glabro subtus dense hirsuto 5–6 mm. longo suffulta; lamina oblanceolata vel anguste obovata, 8.5–12.5 cm. longa, 2.5–4 cm. lata, caudato-acuminata, basi acuta, subcoriacea, supra nitidula, siccitate supra saturate subtus dilute brunnea, supra glaberrima et dense nigro-punctata, subtus costa nervisque satis dense et inter nervos sparse hirsuta et albo-punctata, nervis utroque latere costae 5 subtus prominulis sub margine arcuatim collectis, venulis pluribus e costa ortis patentibus. *Stipulae* petiolum margine satis lato cingentes, supra petiolum in vaginam villosam 4 mm. altam connatae et utrinque in aristas duas villosas 2.5 mm. longas exeuntes, intus glabrae, axilla sericeae. *Inflorescentia* breviter pedunculata, subglobosa, 1.5 cm. diametro, dense hirtella; bractee lineares, 4 mm. longae, basi dilatatae et appendicibus utroque latere 3 pectinatae, extra et praesertim margine hirtellae, intus subglabrae; bracteolae anguste lineares, 3 mm. longae, basi interdum subdilatatae, et hinc inde appendicibus brevibus munitae, extra hirtellae. *Flores* sessiles, 5-meri. *Ovarium* semi-inferum, extra sparse et brevius hirtellum, usque ad calycis insertionem, 0.6 mm. altum. *Calyx* extra et praesertim margine hirtellus, intus glaber, tubo 0.7 mm. alto, lobis linearibus subobtusis 2.5 mm. longis 0.7 mm. latis. *Corollae* tubus cylindricus, 3 mm. altus, 0.8 mm. diametro, extra glaber, intus fauce dense albo-barbatus; lobi crassiusculi, extra dense hirtelli, intus glabri, 1.8 mm. longi, 0.5 mm. lati.

Stamina in corollae fauce inserta, filamentis glabris applanatis 0.7 mm. longis, antheris basifixis ovoideis obtusis 0.8 mm. longis. *Discus* (dimidium superius ovarii) glaber, 0.5 mm. altus. *Stylus* glaber, stigmatibus filiformibus 0.3 mm. longis comprehensis 4 mm. longus, i.e., sicut stamina breviter exsertus. *Drupa* ignota.

SARAWAK. Sine loc., *Beccari* 1799 (typus, Herb. Kew.).

The half-inferior ovary, but perhaps even more the peculiar way in which the petioles are surrounded by a collar-like excrescence from the stipular sheath, and the black dots on the upper side of the leaves assign to this plant a place in the genus *Gaertnera* Lam. On account of the long calyx lobes it occupies an isolated position, for in the other species the calyx is cupular and subtruncate.

XXVII—PLANTS NEW TO ASSAM: XII.*

The regions in round brackets indicate the localities from which the species have been previously recorded.

Lonicera deleiensis C. E. C. Fischer et K. N. Kaul, sp. nov. [Caprifoliaceae]; *L. angustifoliae* Wall. affinis, foliis haud lanceolatis haud acutis subtus vix albis, bracteis ovatis, floribus duplo majoribus distat.

A small *shrub*; branchlets solid, reddish, shining, 2–3 mm. diam., peeling, nodes sometimes considerably swollen; lateral twigs short, subtended by numerous brown, ovate, keeled scales up to 2 mm. long. *Leaves* varied, nearly circular, broadly elliptic, ovate or obovate, apex rounded or slightly narrowed, obtuse, base usually cuneate, sometimes rounded, 1–5 cm. long, 0.7–3 cm. wide, primary nerves 4–9 pairs, with the midrib and fine reticulations slightly impressed above, brown (when dry) and glabrous above, pale below and abundantly dotted with minute grey scales, margins slightly revolute; petioles 2–3 mm. long. *Inflorescence* axillary; peduncles solitary, slender, 2.5–3.5 cm. long; bracts free, ovate, obtuse, 5–5.5 mm. long; bracteoles united into a thin, entire cup 2.5 mm. long. *Ovaries* completely fused into a sessile subglobose element 3.2 mm. long, each 2–3-celled. *Calyx* yellowish; tube very short, with a fold across the outer side; lobes 5, ovate or oblong, obtuse, 7 mm. long. *Corolla* tubular-funnel-shaped, base slightly oblique, 1.1–1.2 cm. long, glabrous without, hairy on the upper $\frac{3}{4}$ within; lobes 5, nearly circular or broader than long, 5–5.5 mm. diam. glabrous outside, minutely papillose within. *Stamens* 5, inserted a little below the middle of the corolla tube, included; filaments 1.5–2 mm. long, glabrous; anthers linear, 2 mm. long. *Style* subulate, 5 mm. long, glabrous; stigma capitate, 1.5 mm. diam. *Fruit* not seen.

DELEI VALLEY; 28° 20' N., 96° 37' E., 3380–3700 m., fls. June, F. Kingdon Ward 8349: "Scattered in the *Abies-Rhododendron* forest. Fls. opening pink, usually fading white."

* Continued from K.B. 1940, 42.

Lonicera Henryi Hemsl. [Caprifoliaceae] (N. Burma, W. China).

DELEI VALLEY ; 28°20'N, 96°35'E, 2450–2770 m., fls. late July, *Ward* 8498 : “ Twiner in *Tsuga-Rhododendron* forest. Fls. cream.” 2770–3000m., fls. mid-Aug., *Ward* 8558 : “ Twiner in thickets along the ridge. Fls. opening cream, later turning a darker yellow.”

Lonicera Kingdonii C. E. C. Fischer et K. N. Kaul, sp. nov. [Caprifoliaceae] ; *L. tanguticae* Max. affinis, foliis obovatis acutis glabris, bracteolis praesentibus, corollis basi angustis, stylis inclusis differt.

A small *shrub* ; branchlets solid, pale-brown, 2–3 mm. diam, peeling ; ultimate twigs bifarious, very slender, 3–12 cm. long, reddish-brown, subtended by several pale-brown, ovate or lanceolate, acute, keeled scales 3–4 mm. long. *Leaves* membranous, elliptic, elliptic-lanceolate or elliptic-oblong, tapering to an acute or subacute apex, base cuneate, 2–5 cm. long, 0.7–1.3 cm. wide, when dry dark-olivaceous above, greyish below, midrib impressed above and slightly raised below, primary nerves 5–9 pairs, ultimate reticulation minute, clearly visible below, very slightly (under the lens) bullate above, margins slightly revolute, at least when dry ; petioles 2–4 mm. long, slightly widened at the base and the opposite pairs joined by a shallow ridge. *Inflorescence* axillary ; peduncles solitary, filiform, 2.5–4 cm. long, 2-flowered ; bracts free, narrowly lanceolate, acute, 8.5 mm. long, 1-costate ; bracteoles united into a thin cup 1.6 mm. long. *Ovaries* united in the lower half, ovoid, 2 mm. long, 2-celled, ovule solitary. *Calyx-tube* 0.5 mm. long ; lobes 5 subequal, oblong, subacute, 1 mm. long. *Corolla-tube* cylindric, slightly narrowed at the base, 1.1 cm. long, 10 veined, glabrous without, thinly pubescent within ; lobes 5, slightly unequal, ovate, broadly oblong or semi-circular, 2.5–3.1 mm. long. *Stamens* 5, included, inserted below the middle of the corolla-tube ; filaments filiform, 1.5 mm. long ; anthers linear, 2.2 mm. long. *Style* subulate, 2.3 mm. long ; stigma capitate, globose or broadly oblong, entire, 1 mm. long. *Fruit* not seen.

DELEI VALLEY ; 28°21'N., 96°37'E., in forest at 3080–3390 m., fls. June, *Ward* 8331 : “ Fls. white, faintly tinged with purple.”

Viburnum cordifolium Wall. [Caprifoliaceae] (Kumaon to Bhutan).

DELEI VALLEY ; 28°21'N., 96°37'E., 3370–3680 m., fls. June, *Ward* 8314 : “ With birch and scrub *Rhododendron* all along the ridge in *Abies* forest, especially where there is bamboo. A scrub bush with fragrant white flowers, anthers purple.” 28°15'N., 96°35'E., 2760–3680 m., fls. and young frt. late Aug., *Ward* 8618 : “ Small tree very common in *Rhododendron* forest. Berries now red, a few already black.” 28°15'N., 96°40'E., 3680 m., ripe frt. early Oct., *Ward* 8687 : “ Small shrub along open ridges amongst *Rhododendron* and other shrubs. Ripe berries black.”

Androsace Henryi Oliv. [Primulaceae] (N. Burma, W. China).

DELEI VALLEY ; 28°15'N., 96°35'E., 2770–3100 m., frt. Aug., Ward 8565 : " On steep shady bank of North-facing gully in *Rhododendron-Tsuga* forest ; heavily shaded and more or less hidden amongst undergrowth."

Buddleja Hookeri Marq. [Loganiaceae] (Sikkim, N. Burma).

DELEI VALLEY ; 28°15'N., 96°35'E., 2770 m., fls. late Aug., Ward 8598 : " Small shrub in thickets on the sunny slope. Fls. cream with orange centre ; very fragrant."

Onosma emodi Wall. [Boraginaceae] (Garhwal to Bhutan, S. Tibet).

DELEI VALLEY ; 28°21'N., 96°37'E., 3380 m., fls. June, Ward 8348 : " In colonies on ledges of gneiss cliffs in *Abies-Rhododendron* forest facing south. Fls. in drooping heads, opening purple but ultimately more or less blue.

Trigonotis rotundifolia (Wall.) Benth. [Boraginaceae] (Punjab to Sikkim).

DELEI VALLEY ; Kaso, 28°21'N., 96°37'E., 3650–4000 m., fls. and frt. early July, Ward 8418 : " On steep subalpine slopes facing South. Fls. pale sky-blue."

Chirita stolonifera C. E. C. Fischer et K. N. Kaul, sp. nov. [Gesneriaceae] ; *C. lachenensi* C. B. Clarke peraffinis, caule stolonifero, foliis solitariis cordatis, maturis subtus glabris, pedunculis 1- raro 2-floris, inflorescentia haud glandulosa differt.

A stoloniferous *herb* ; stolons slender, up to 20 cm. long, nearly black, sparsely (densely when young) crisped brown-hairy. *Leaves* solitary, radical, thinly membranous, cordate, obtuse, sinus usually deep, basal lobes rounded, equal or somewhat unequal, 5.3–10.5 cm. long, 4.5–8 cm. wide, primary nerves 6 pairs, silvery-brown felted on both faces at first, when mature dark and sparsely dotted with short hairs above, paler and glabrous or nearly so below, margins distinctly and shallowly crenate-serrate or sometimes more closely and coarsely dentate ; petioles 7–20 cm. long, densely brown-villous when young, becoming nearly glabrous with age. *Peduncles* erect, solitary in the axils of the young leaves, usually 1-, rarely 2-flowered, slender, dark, sparsely brown-pilose, 6–8 cm. long ; bracts 2, opposite, above the middle of the peduncle but well below the nodding flower, up to 4 mm. long, brown-hairy. *Calyx-segments* 5, nearly free, caducous, narrowly lanceolate, acuminate, subequal, 5–7 mm. long, sparsely brown-pilose. *Corolla* funnel-shaped, mouth oblique, puberulous without ; tube 1.7–2 cm. long, glabrous within, with 2 longitudinal folds opposite the stamens ; limb 2-lipped, lobes 5, rounded, subequal, 7–10 mm. diam. *Stamens* 2, included, inserted a little below the middle of the tube ; filaments ensiform from a moderately broad base, 4–5 mm. long, pubescent upwards ; anthers rounded, 2 mm. diam. *Staminodes* 2, linear, short. *Ovary*

sessile, linear, 5.6 mm. long, puberulous ; style as long, puberulous ; stigma funnel-shaped. *Capsule* (immature) linear, straight, 4 cm. long, glabrous.

DELEI VALLEY ; 28°21'N., 96°37'E., 1850-2150 m., fls. July, Ward 8462 : " On rocks and banks in the forest. Fls. more or less hidden beneath the leaves, mouth of corolla pure violet, throat white with yellow streaks."

Radermachera Borii C. E. C. Fischer, sp. nov. [Bignoniaceae] ; *R. xylocarpae* (Roxb.) K. Sch. similis, sed foliolis caudatis, calycibus majoribus lageniformibus inferne valde 5-sulcatis, corollis anguste infundibularibus, capsulis multo angustioribus spiraliibus, seminibus minoribus.

A tree. Leaves bipinnate, 35 cm. or more long ; petiole sulcate above ; pinnae, 4 pairs and a terminal, up to 17 cm. long, partial petioles terete, up to 3.5 cm. long, the lower the longer ; leaflets 2-3 pairs and a terminal (uppermost 3-foliolate), lanceolate, caudate, base acute, 4.5-8 cm. long, 1.5-3 cm. wide, primary nerves 4-6 pairs, dark-olivaceous (when dry) and minutely puberulous above, especially on the midrib and nerves, paler and dotted with minute discoid scales below ; petiolules terete, 4-15 mm. long, the lowest the longest, glabrous or minutely puberulous. *Cymes* dichotomous apparently few-flowered ; partial rhachises (in fruit) somewhat compressed, pale-brown ; pedicels terete, 4-4.5 cm. long. *Calyx* fleshy, flagon-shaped, 2.7 cm. long, swollen and thickened at the base, 1.2 cm. diam., 5-grooved, tubular portion 7-8 mm. diam., longer than the swollen portion, 5-ribbed, the ribs arising from the apices of the grooves, shortly split anteriorly ; lobes 3, unequal, ovate, obtuse, 4 mm. long. *Corolla* cylindric-funnel-shaped ; tube 4 cm. long, 4 mm. diam. at base, 8.9 mm. diam. at the mouth and there slightly laterally compressed ; lobes 5, rather fleshy, rotund-oblato, much plicately imbricate in bud, margins crisped, 1.5 cm. long, 2 cm. wide. *Stamens* 4 perfect, inserted about $\frac{1}{3}$ up the corolla tube ; filaments subulate, 2.8 cm. long ; anthers of 2 divaricate, linear cells 4 mm. long, connective apiculate, 1.3 mm. long ; staminode 0 or 1 slender, less than half as long as the filaments. *Disk* annular, 1 mm. long. *Ovary* linear, 6.3 mm. long, covered with minute discoid scales ; ovules in 8-10 rows ; style slender, overtopping the anthers ; stigmas 2, oblate, flat, 3 mm. long, 4 mm. wide. *Capsules* slender, acuminate, subterrate, spiral, up to 45 cm. long, 4-5 mm. diam., pale brown, dotted with very small tubercules ; septum lenticular in section, longitudinally sinuate ; seeds usually 2.5-3 mm. long, 4-5 mm. wide, and with a wing spread of 1.1 cm., but sometimes a few larger, 4 mm. long, 6 mm. wide, spread 2.5 mm.

NAGA HILLS ; Khonoma, 1850 m., fls. Aug., frt. Nov.-Dec., N. L. Bor 2699. Corolla cream-coloured. Vernacular name : *Thaprü*. I have only seen a single rather young leaf, detached flowers and one or two cymes in fruit. The description may, therefore, require amplification.

Isotrema Griffithii (Hook. f. et Thoms. ex Duchartre) C. E. C. Fischer, comb. nov. [Aristolochiaceae] (Sikkim, Bhutan).—*Aristolochia Griffithii* Hook. f. et Thoms. ex Duchartre in DC. Prodr. **15**, 1, 437 (1864).

DELEI VALLEY ; 28°21'N., 96°37'E., 2150–2460 m., fls. May, Ward 8226 : “ Twiner among bushes on open ridge at edge of jungle, but in full sun or light. Fls. about 4 in. high, 3 in. across the open mouth ; tube a dirty greenish-white, strongly about 12-ribbed, thickly clothed with rather glistening golden brown silky hairs ; limb dull-purple outside with reticulate veins, inside covered with sharp projecting dull dark-purple spikes ; foetid.”

Iris kumaonensis Wall. [Iridaceae] (Kashmir to Kumaon).

DELEI VALLEY ; 28°21'N., 96°37'E., 3380–4200 m., fls. early June, Ward 8281 : “ In massy clumps on steep gravelly gully-slopes lined with bamboos, along the ridge under bamboos on a rocky outcrop and also on alpine turf slopes. Falls and standards violet ; beard white tinged violet ; sometimes the whole fl. more purple, the falls mottled ; delicately but distinctly fragrant.”

Allium Wallichii Kunth [Liliaceae] (Gilgit to Sikkim).

DELEI VALLEY ; 28°15'N., 96°35'E., 3380–3700 m., fls. just passed, Sept., Ward 8663 : “ In open places on boggy ground or on steep slopes. Fls. violet.” 28°15'N, 96°40'E., 3700 m., fls. early Oct., Ward 8688 : “ On sheltered alpine meadow slopes. 2–3 ft. high ; fls. palest-purple, almost mauve.”

Nomocharis Souliei (Franch.) W. W. Sm. et W. E. Evans [Liliaceae] (W. China, S. E. Tibet).

DELEI VALLEY ; 28°21'N., 96°37'E., 3700–4000 m., fls. late July, Ward 8370 : “ Under bamboos in black, tenacious loam. 12 in. high ; fls. solitary, tepals dull brownish-red with a small yellow area at base, 3 outer shortly saccate at base.”

XXVIII—MISCELLANEOUS NOTES.

The Correct Name for *Akania Hillii* Hook. f.—*Akania Hillii* was first published in Volume I, Part i, of Bentham & Hooker's “Genera Plantarum” (p. 409), which bears the date 1862 upon the title-page. An entry in Bentham's MS. diary shows that this part actually appeared not earlier than August 7th of that year. In vol. 17, p. 28, under date 6.8.62, we read : “ Out at various com[mission]s—to the Linnean Society—to the Printers to settle accounts for the first part of our Genera which is to be out to-morrow” The part was reviewed in Gard. Chron. & Agric. Gaz. 1862, no. 36, 838, dated September 6th.

Bentham, in his account of *Akania Hillii* the following year (Fl. Austral. **1**, 471 : 1863), cited as a synonym *Cupania lucens* F. Muell., and subsequent authors, including the most recent (Harms in Engl. Pflanzenfam. ed. 2, **19b I**, 175 : 1940), have unanimously followed him.

Cupania lucens was published in Mueller's *Fragm. Phytogr. Austral.* 3, 44 (1862). But Fascicle xix, which comprised pages 41–60, was published in July (*vide* p. 60). This gives *C. lucens* at least a week's and at most two months' priority over *A. Hillii*, and the following new combination is accordingly necessary:

***Akania lucens* (F. Muell.) Airy-Shaw, comb. nov.**

Cupania lucens F. Muell. *Fragm. Phytogr. Austral.* 3, 44 (Jul. 1862).

Akania Hillii Hook. fil. in Benth. et Hook. f. *Gen. Plant.* 1, 409 (inter 7 Aug. et 6 Sept. 1862), et auct. omn.

The genus seems so closely related to *Harpullia*, in spite of the differences of calyx, disk, aestivation, etc., pointed out by Stapf and others, that the wisdom of separating it from the *Sapindaceae* may be doubted. Engler's treatment—placing it next to the *Meliaceae*—to which Harms has been obliged to conform (with evident misgivings), appears to indicate a failure to appreciate the value of *facies* (cf. Sprague in Huxley, *The New Systematics*, 441, 449: 1940).

H. K. AIRY-SHAW.

Jacquemontia tamnifolia* (L.) Griseb.—Dr. S. J. v. Ooststroom has written to point out that the identity of *J. capitata* with this species was recognized by H. Hallier as long ago as 1899 in his paper "Zur Convolvulaceenflora Amerikas" in *Jahr. Hamburg. Wiss. Anst.* 1898, 16, Beih. 3, p. 28 (1899). He also used it as an example of a species occurring in both South America and Africa. See *Meded. Rijks Herb. Leiden*, 35, 5 (1918).

A new *Strychnos* from Thailand.—In working over the Thai species of *Strychnos* for the *Florae Siamensis Enumeratio* it was found that a specimen collected by Dr. A. F. G. Kerr at Krabi in Southern Thailand represented a new species. This is closely allied to *S. ovalifolia* Wall. of the Malay Peninsula, but has not got the characteristically abbreviated inflorescence of that species. *S. Wallichiana* Benth. is also closely allied, but differs in having constantly oblong leaves and a hairy style.

***Strychnos krabiensis* A. W. Hill, sp. nov.** ex affinitate *S. ovalifoliae* Wall., a qua inflorescentiis longioribus, floribus paullo majoribus recedit; a *S. Wallichiana* Benth. foliis ellipticis vel ovato-ellipticis, nec oblongis, stylo glabro differt.

Planta scandens, lignosa, cortice haud annulata (*fide* Kerr). *Ramuli* teretes, glabri vel primum breviter et patule pubescens. *Petioles* 1 cm. longi, supra basi crassa articulati, canaliculati, glabri. *Lamina* elliptica vel ovato-elliptica, 8–13 cm. longa, 5–5.75 cm. lata, basi subabrupte angustata vel rotundata, apice acumine 1 cm. longo instructa, e basi valide trinervis, nervis intramarginalibus ut

* See K.B. 1940, 63.

secundariis tenuioribus, utrinque glabra. *Inflorescentiae* e cymis paniculatis compositae axillares, efoliatae, ut videtur circiter 7 cm. longae. *Pedunculus* communis 3-3.4 cm. longus, glaber. *Rami inflorescentiae*, ut pedicelli, pilis brevibus fulvo-brunneis patule pubescentes. *Flores* laterales pedicellis 3-4 mm. longis instructi, terminales sessiles. *Calyx* sepalis 5 ovoideo-triangularibus subacutis vel acutis 1.75 mm. longis pubescentibus. *Corolla* 1.3 cm. longa, tubo 1.1 cm. longo intus ad basin versus piloso lobis 5 triangularibus subacutis 2 mm. longis. *Stamina* 8 mm. supra basi tubi affixa. *Antherae* 2 mm. longae, dorsifixae, subsessiles. *Ovarium* globosum, 1 mm. diametro, glabrum; stylus 6.5 mm. longus, glaber.

THAILAND. Puket: Krabi, Ao Luk, c.100 m., in evergreen forest on limestone hill, 10 March, 1930, *Kerr* 18532. Native name *Ya mû lek*.
A. W. HILL.

The New Systematics.*—This book is a collection of essays by twenty-two contributors on diverse topics directly or indirectly bearing upon the modern problems of taxonomy. Rather less than half of these are mainly botanical. The Editor contributes a helpful introduction which is in some sense a summary of the contents and which serves to bring into focus the rather disconnected chapters of the other contributors.

The objectivity of species, that is stressed by certain of the writers, and the aggregate character of species, emphasised by others, are both important aspects of what Huxley rightly claims are groups that, in the great majority of instances, present no intrinsic difficulty in their separation. The individuals that comprise species are frequently subject to genetic change, and the consequences of such may transcend the limits which one or other biologist regards as justifiably included within their species concept. In this degree the species must be an aggregate depending upon human judgment, although there are many instances where the limits of the specific group are clearly defined alike by geographical and physiological isolation. Yet the normal view of species breaks down where there are hybrid swarms, where apomixis occurs or where descent is reticulate. Thus the necessity arises for the experimental culture of taxonomic units with which W. B. Turrill deals. Most will probably endorse his view that it is only by a combination of all the methods of investigation that there is any hope of obtaining satisfactory evidence on the nature and genesis of taxonomic unity.

J. S. L. Gilmour starts on the high note of epistemology and philosophical promise, but if the fulfilment, as he himself is the first to admit, be somewhat vague, it is well that we should not lose sight of the fact that our only knowledge, even of type specimens, is a complex of sense impressions, the character of which is to

* Edited by Julian Huxley. Sponsored by the Association for the Study of Systematics in relation to General Biology. Oxford: at the Clarendon Press, 1940. Pp. viii+583. Price, 21s. net.

some extent conditioned by the individuality of the sensory mechanism.

The phylogenetic basis of classification is claimed both by Sprague and Calman. Gilmour, on the other hand, regards phylogeny as forming a sort of background to natural classification. Much of such difference in point of view may be an outcome of the common confusion of thought between affinities and phylogeny, a distinction with a real difference. A crude illustration will make this point clear. If the problem were to classify a number of human beings of unknown relationships but including members of several families with near and distant relatives, it is quite probable that an intelligent and competent observer would be able, on the basis of resemblances in morphology and behaviour, to place the members of the respective families and some of their nearer relatives into separate groups. One might further draw the not unreasonable inference that these resemblances were indications of probable affinity, but they would afford little if any clue to the phylogenetic relationships. We should be entirely unguided as to whether two individuals exhibiting a certain degree of resemblance were for instance, cousins or an uncle and a nephew. The study of taxonomy is essentially one of the study of differences and resemblances and though such may guide us in assessing affinities it is only rarely in the past that we have obtained any real clue to phylogeny. Occasionally, as W. J. Arkell and J. A. Moy-Thomas in their chapter on "Palaeontology and the Taxonomic Problem" show, fossil evidence may indicate the phylogeny of lineages, but they state that "the major problems of palaeontological taxonomy may be summarised by saying that a phylogenetic and a practical classification are frequently incompatible." Too often our series, if and when established, are capable of being viewed from either direction, and to expect our taxonomic system, which ought to be a summation of all ascertained facts, to be more than an always imperfect, but ever improving, indication of affinities, with but rare adumbrations of phylogeny as a by-product, is to expect a complex differentiating process to be confined to the straight jacket of our preconceptions and prejudices. The contributions of cytology and genetics bid fair to provide far more frequent and reliable indications of immediate phylogeny than in the past, particularly, as Darlington indicates, within the species; but even so, the complexity and variety of the ways in which the hereditary changes come about will maintain the problematic character of phylogenetic speculations.

The examples given in the chapter contributed by Timofeeff-Ressovsky show that the various types of combination and mutation, gene, chromosome or genome, and their experimentally ascertained effects are adequate to account for subspeciation and geographical variation when subject to the action of selection and isolation. This topic is also treated by Muller, who discusses how the investigations on *Drosophila* have shed light on the processes by which

organisms have come to be differentiated and tend to show that species originate by the accumulation of small differences. The distinction which Timofeeff-Ressovsky makes between micro- and macro-evolution is important, since the former can be the subject of experimental test, whereas to attribute the latter entirely to the same causes is at present mere speculative extrapolation that may, or may not, prove justified.

Several of the contributors treat, from various aspects, of the importance of isolation. The effect of geographical isolation is considered in relation to fishes by E. B. Worthington, who stresses the significance of unoccupied ecological niches and the absence of predators. He also draws attention to the higher rate of differentiation of cold-blooded animals in warm waters. Darlington, writing on taxonomic species and genetic systems, deals with the isolating action of internal changes, such as an inverted chromosome segment, and discusses the significance and consequences of structural hybridity. Sewall-Wright from a consideration of certain statistical aspects of mendelian heredity concludes that partial isolation of large interbreeding groups furnishes the most favourable conditions for evolutionary change, and Diver, who writes on the subject of closely allied species living in the same area, holds that random differentiation in small partially isolated populations is the most probable general cause.

The ecological significance of sub-specific groups is considered by Salisbury, who also treats of the effects of plasticity, such as its influence on isolation.

Other contributors deal more especially with aspects which present difficulties in classification. Thus de Beer, treating of the contribution of embryology to taxonomy, points out the special problems that may arise as, for example, where the classification of adult forms is not congruent with that based on the larval stages. Thorp in relation to insects stresses the occurrence of species which are physiologically but not morphologically distinct. Ford discusses polymorphism, whilst Allen discusses wild hybrids. Crane and Vavilov write on the subjects of the origin and taxonomy of cultivated plants, and Ramsbottom deals with the special problems presented by the classification of the Fungi. Finally Smart envisages the practical problems which face the entomologist, and Calman, from his wide experience, lays emphasis upon the rarity of aberrant types.

It is clearly impossible in a short review to do more than indicate the nature of the contents of so varied a series of essays as are comprised in this volume, but it will be obvious from the foregoing that most aspects of taxonomic problems are considered in its pages and that it is a work that should be studied by all who are interested in the classification of either plants or animals.

E. J. SALISBURY.

Planting Design.*—This book by the Assistant Professor of Landscape Architecture in the University of Illinois is naturally written for American readers, and though it contains much of value on garden design and planning in relation to colour effects and in connexion with the house itself, much of the work will be more fully appreciated in the United States than in this country, where we seem to manage by our own innate "flair" for garden design and planting to achieve good results without professorial aid!

Following a useful introduction come chapters on "Color Theory" and "The Use of Color" in which much sound advice on the proper blending of colours is given and suggestions as to the plants to be used to produce the desired results. Then come chapters on "Texture," "The Attributes of Mass" and "Mass: grouping and arrangement," which deal with the many elusive qualities of light and shade, harmony in design, shapes of trees and shrubs and the pattern produced by well-blended colour, whether of flowers or different shades of foliage.

Part II deals with the ecological factors of soil and climate which should be of great value to American readers and also useful to horticulturists in this country. Part III is headed "Applications," and the themes considered are "Planting about Buildings" and "Public Plantings," both chapters being well illustrated; these show that Professor Robinson has a fine sense of the relation that should exist between the layout of the garden and the house to which it leads up.

The book concludes with a series of interesting "problems" which deserve careful study by anyone who may be designing a garden, especially in relation to its surroundings.

The Scientific Principles of Plant Protection.†—It is interesting to note the publication of a third edition of Martin's well known "Scientific Principles of Plant Protection" only four years after the appearance of the second (K.B. 1936, 444). The new edition follows the same lines as the last, the sequence and titles of the chapters being the same as before, and the book only a few pages longer. Whilst the book is mainly concerned with the principles of controlling fungus diseases and insect pests of plants and the soil in which they grow by chemical methods, there are important chapters dealing with Plant Resistance, Biological Control, Traps, and the Elimination of Infection Centres. Recent developments in these subjects have been fully summarized, whilst the text of the second edition has been shortened in places in order to make room for the fresh information. It is impossible to note

* By Florence Bell Robinson. Published by the McGraw-Hill Publishing Company Ltd., Aldwych House, London, W.C.2. Pp. 215. Illustrated. Price 15s. net.

† "The Scientific Principles of Plant Protection, with special reference to Chemical Control." By Hubert Martin. London, Edward Arnold and Co., 1940. Pp. x+385. Price 22s. 6d. net.

in detail all of the changes which have been made, but some of the more comprehensive alterations are in the sections dealing with the "spreaders" and "stickers" used in spray fluids, the copper fungicides, the measurement of the degree of toxicity, and the spread of virus diseases. Those who have attempted to destroy slugs in their gardens will almost certainly agree with the recommendation to use metaldehyde ("Meta") for this purpose rather than the sulphates which have hitherto been commonly employed. It is rather curious, however, that the elimination of slugs should still be discussed in a chapter on "weed killers." It is to be hoped that the new edition of Mr. Martin's book will be accessible to all those who are interested in cultivating crop plants under the best possible conditions, the importance of which is, if possible, even greater now than in time of peace.

C. R. METCALFE.

Mr. C. E. C. FISCHER, who was appointed to the post of Assistant for India in the Herbarium at Kew on January 26th, 1925 (see K.B. 1925, 41), retired from this post on reaching the age limit on June 30th, 1940. He is succeeded by Mr. K. N. KAUL, M.Sc., whose selection for this post, by the Government of India, was announced in the Bulletin, 1939, 313.

Since the announcement of Mr. Kaul's appointment, the Government of India decided to retain Mr. Fischer's services as Assistant for India until the end of June, 1940, so that Mr. Kaul might have the full benefit of his knowledge of the Indian Flora and of the historic Indian collections in the Herbarium.

Mr. Fischer entered the Royal Indian Engineering College, Coopers Hill, as a Probationer for the Indian Forest Service in 1892, and on passing out at the end of 1895, he joined the Service in the Madras Presidency. During his time in India he was a constant collector of botanical specimens. After a short term at Dehra Dun in 1907 as acting Forest Entomologist, he studied Plant Pathology at Munich and London while on study leave in 1908-9. From 1915 to 1917 Mr. Fischer was Principal of the Madras Forest College. In 1920 he became Conservator of Forests and remained in that post until he left India at the end of 1923. He finally retired from the Indian Forest Service in 1926.

After the death of Mr. J. S. Gamble in 1925, Mr. Fischer undertook the completion of the Flora of the Presidency of Madras, which had been begun by Mr. Gamble in 1915. Parts 8, 9, 10 and 11 were prepared by Mr. Fischer, the final part appearing in February, 1936.

During his service of more than fifteen years at Kew, Mr. Fischer's kindness and enthusiasm have endeared him to all his colleagues, and they wish him many years of activity and happiness in his retirement.

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